CLAIMS:

1. A fluoride crystalline optical lithography lens element blank, said fluoride crystalline optical element blank comprising a plurality of crystalline subgrains, each of said subgrains having a crystalline subgrain structure, said fluoride crystalline blank including at least a first subgrain structure and a second subgrain structure, said second subgrain structure adjacent and abutting said first subgrain structure at a first defect boundary formed by a plurality of dislocation defects, said boundary dislocation defects having an adjacent first subgrain - second subgrain boundary angle, said first subgrain - second subgrain boundary angle less than two minutes, said crystalline optical element blank having an impurity level less than 1 ppm Pb by weight, less than .5 ppm Ce by weight, less than 2 ppm Na by weight and less than 2 ppm K by weight, said blank having a 157 nm absorption coefficient less than .0022/cm base 10 absorption coefficient and a 193 nm absorption coefficient less than .00043/cm base 10 absorption coefficient, said blank having an optical homogeneity less than 2 ppm and an average birefringence less than 2 nm/cm RMS with a maximum birefringence less than 5 nm/cm.

2. A fluoride crystalline optical blank as claimed in claim 1, said blank comprising a third subgrain structure, said third subgrain forming a second defect boundary with an adjacent abutting subgrain structure, said second defect boundary having a second adjacent subgrain boundary angle, said second adjacent subgrain boundary angle less than two minutes.

3. A fluoride crystalline optical blank as claimed in claim 1, wherein said first subgrain - second subgrain boundary angle is less than or equal to one minute.

4. A fluoride crystalline optical blank as claimed in claim 2 wherein said second adjacent subgrain boundary angle is less than or equal to one minute.

5. A fluoride crystalline optical blank as claimed in claim 1 wherein said blank is comprised of calcium fluoride.

6. A fluoride crystalline optical blank as claimed in claim 1 wherein said blank is comprised of barium fluoride.

7. A fluoride crystalline optical blank as claimed in claim 1 wherein said blank has an impurity level of less than 100 ppb Pb by weight.

8. A fluoride crystalline optical blank as claimed in claim 1 wherein said blank has an impurity level of less than .5 ppm Na by weight.

9. A fluoride crystalline optical blank as claimed in claim 1 wherein said blank has an impurity level of less than .5 ppm K by weight.

10. A fluoride crystalline optical blank as claimed in claim 1 wherein said blank has a 205 nm lead absorption < .23 $cm^{-1}$ local extinction at 205 nm.

11. A fluoride crystalline optical blank as claimed in claim 1 wherein said blank has a 306 nm cerium absorption < .35 x $10^{-3}$ $cm^{-1}$ local extinction at 306 nm.

12. A fluoride crystalline optical blank as claimed in claim 1 wherein said blank is free of an oxygen absorption peak within the wavelength range of 140 to 150 nm.

13. A fluoride crystalline optical blank as claimed in claim 1 wherein said blank has an average birefringence less than 1 nm/cm (RMS) with a maximum birefringence less than 2 nm/cm.

14. A fluoride crystalline optical blank as claimed in claim 1, said blank having a large dimension surface, said blank surface having a plurality of surface subgrains bounded by adjacent abutting subgrains with disorientation boundary angles in the range from > 20 seconds to < 2 minutes, wherein said blank surface has at least three surface subgrains per $cm^2$.

15. A fluoride crystalline optical blank as claimed in claim 13 wherein said large dimension surface has a surface area of at least 300 $cm^2$.

16. A fluoride crystalline optical blank as claimed in claim 14 wherein said blank consists essentially of a plurality of calcium fluoride subgrains bounded by adjacent abutting calcium

fluoride subgrains with disorientation boundary angles in the range from > 20 seconds to < 2 minutes.

17. Method of making a fluoride crystalline optical lithography lens element blank, said method including:

forming a fluoride crystalline melt,

crystallizing said melt into a fluoride crystalline member with a large dimension ≥ 200 mm,

annealing said fluoride crystalline member,

qualifying said annealed fluoride crystalline member to provide a fluoride crystalline optical lithography lens element blank with a 157 nm internal absorption coefficient less than .0022/cm and a 193 nm internal absorption coefficient less than .00043/cm, a 205 nm lead absorption < .23 $cm^{-1}$ local extinction, a 306 nm cerium absorption < $.7x10^{-3}$ $cm^{-1}$ local extinction, an average birefringence less than 2 nm/cm with a maximum birefringence less than 5 nm/cm, and an optical homogeneity less than 2 ppm with a surface subgrain disorientation boundary angle ≤ 2 minutes.

18. A method as claimed in claim 17 wherein forming a fluoride crystalline melt includes melting a high purity calcium fluoride raw material having by weight impurity levels of ≤ 1 ppm Li, ≤ 3.3 ppm Na, ≤ 3.8 ppm K, ≤ .5 ppm Mg, ≤ 19 ppm Sr, ≤ .5 ppm Ba, < .2 ppm Sc, < .2 ppm Y, < .2 ppm La, ≤ .2 ppm Gd, < .2 ppm Yb, < .2 ppm Ti, < .2 ppm Cr, ≤ 4.2 ppm Mn, ≤ .4 ppm Fe, ≤ .2 ppm Co, < .2 ppm Ni, ≤ .3 ppm Cu, < 200 ppm O.

19. A method as claimed in claim 17 wherein forming a fluoride crystalline melt includes providing at least one deoxygenated densified solid fluoride crystalline disk having a diameter ≥ 200 mm and melting the at least one deoxygenated densified solid fluoride crystalline ≥200 mm diameter disk.

20. A method as claimed in claim 17 wherein forming a fluoride crystalline melt includes forming a calcium fluoride melt and qualifying includes analysis of oxygen absorption peaks within the wavelength range of 140 to 150 nm.

21. A method as claimed in claim 17 wherein qualifying includes measuring the absorption spectrum of the member from 200 to 220 nm for the 205 nm lead absorption peak and exciting the member with 203 nm excitation radiation and measuring the luminescence spectrum produced by exciting the member.

22. A method as claimed in claim 21 wherein qualifying includes detecting the member's surface subgrain disorientation boundary angles.

23. A method as claimed in claim 22 wherein detecting includes exposing a fluoride crystalline blank to a synchrotron radiation source.

23. A method as claimed in claim 22 wherein detecting includes detecting radiation diffracted by the fluoride crystalline blank.